

The value of HRCT Chest in Diagnosis of COVID 19 and its Correlation with RT-PCR

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ABSTRACT

Objective: The objective of the study is to link pulmonary participation CT findings in COVID-19 positive patients with clinical findings and the impact of the CT Score in the results of patients' predictions.

Study Design: Single-centered retrospective analysis

Place and Duration of Study: The study was performed between June and November 2020. Research was conducted in Sargodha District Headquarters Teaching Hospital.

Methodology: 138 COVID-19 patients were recorded for chest CT analysis and clinical evaluation from June to November 2020 who were positive for reverse transcriptase polymerase chain reaction. Based on the spectrum of lobular participation, quantitative CT scores were taken into account. Clinical results linked the data.

Results: 106 (76.8%) of patients were males and 32 (23.18%) were women. Of the 138 positive individuals, 51 (36.9%) were classified as severe and 87 (63.04%) were classified as light. 89 (64.4 percent) individuals have normal chest CT, whereas 49 (35.5 percent) have parenchymal abnormalities. Among patients with abnormal CT results, multilobar (88.2 percent) with a predominant peripheral and post-distribution is often found in 39/51 (76.5 percent). Ground glass opacity is the main anomaly in all 48 (97.9%) instances. Pure ground glass opacity is seen in 13 (27.08 percent) while mixed consolidated ground glass opacity is reported in 17. (35.4 percent).

Conclusion: Chest CT results have a possible function in the prediction of good patient consequences of COVID-19. Diagnostic process can be helpful since CT results are associated with disease severity and clinical symptoms.

KEYWORDS: COVID-19, High-resolution computed tomography, Chest X-ray (CXR) and RT-PCR

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I. INTRODUCTION

The recent explosion of the new SARS-CoV-2 coronavirus in Wuhan, in the province of Hubei in China has turned pandemic. WHO Emergency Committee proclaimed a global health emergency in response to emergencies in China and other

nations of the world¹. More than one million coronavirus fatalities have been caused, which indicate an alarming number². Because of environmental, socio-economic and ecological variables, epidemics of human illnesses have been diversified since the 1980s. Coronaviruses were not thought to be very pathological before the development of severe acute respiratory syndrome

in 2003 in China and Saudi Arabia in 2012.³

The literature focuses on high resolution compute tomography (HRCT), a kind of CT (computed tomography) since it is more delicate than chest x-rays. CT was the initial line of research for COVID-19 in China⁴. The reason why this method is used for patients with COVID-19 is that HRCT is highly sensitive⁵. The sensitivity of simultaneous pharyngeal and nasal swabs is not sufficient, depending on the manner of specimen collection and the technical individuality of the test. COVID-19 patients should not be diagnosed promptly for pharyngeal and nasal swab specimens because of lengthy TAT for viral testing coupled with a faint RT-PCR sensitivity (real-time reverse-transcriptase polymerase chain reaction). Chest diagnostic imaging, together with clinical symptoms, epidemiological history and laboratory testing, has a key significance in the diagnosis and gravity evaluation of COVID-19.

Chest CT imaging has shown that it is responsive to certain of COVID-19 symptoms than chest radiography (CR). The objective of this study was to evaluate the possible usefulness of chest CT in early identification of COVID-19 and to investigate its relevance in the management of the patient population in Pakistan.

II. METHODOLOGY

In this investigation, symptomatic 352 individuals (females, men; mean age 58 ± 12 years) were assessed from June to October 2020 with clinically suspected COVID-19. The DHQ Teaching Hospital Sargodha Ethical Committee authorised the study and fully completed informed approval forms for applicants. The study eliminated patients with negative RT-PCR results. Of 352 patients with RT-PCR, 138 had SARS-Cov-2 positive findings and so had Chest CT imaging. Chest CT exams were done in a special COVID-19 dedicated CT scan room of our Emergency Radiology Unit with a 64-slice scanning system (Siemens SOMATOM Sensation, Siemens Medical Solutions, Forchheim). All data were rebuilt with a slice thickness of 1.0 mm to get high-resolution pictures. The severity of the illness was assessed according to the standards established by the Center of Disease Control (CDC).

Nine findings of CTs were seen as ground glass opacities (GGOs), consolidation, GGO and consolidation mixed, single or multiple solid nodules surrounded with ground glass (halo sign), wall thickening bronchial, air bronchogram, interlobular septal thickening, pleural effusion,

and mediastine lymph node enlargement. Ground-glass attenuation was described as a vast rise in lung opacity with bronchial and vascular periphery preservation. The consolidation of the arteries and the airway walls is characterised as an even rise in parenchymal pulmonary attenuation. In areas not adjacent to areas of soil glass attenuation and/or consolidation, bronchial wall thickening was identified. Air bronchograms were characterised as a pattern of air-filled bronchi on a high-matrix airless lung backdrop. Interlobular septal thickening was determined by the thickness and visibility of a septum compared to normal circumstances. Mediastinal lymphadenopathy was assessed when the lymph node's minimum diameter was more than 10 mm. The anomalies were unilateral or bilateral. The distribution was ranked as peripheral, centro-globe, peripheral and centro-globe, focal, multifocal and diffuse. Focal was defined as a single anomaly, multifocal, and diffuse as a broad involvement of most of one lung capacity. The upper and lower lung distributions were categorised as dominating. Chest CT was divided in four categories (typical CT pattern, probable CT pattern, inconsistent and negative CT patterns for pneumonia) and afterwards into CT negative (inconsistent CT pattern and pneumonia negative) and CT positive (typical and potential CT pneumonia pattern) for COVID-19. This categorization enabled doctors and anesthesiologists quickly assign patients to a lung parenchyma involvement unit.

Statistical analyses have been carried out using SPSS (v. 25). Mean values of continuous variables as standard deviation were expressed (SD). For single comparisons, Mann-Whitney test was employed, whereas Kruskal-Wallis test was used for many comparisons. Percentages of demographic properties were stated and then compared with the exact test of Fisher. An important statistical p-value was <0.05 .

III. RESULTS

Of 138 positive individuals, 51 (36.9%) were classified as severe while 87 (63.04%) were classified as light. 106 (76.8%) of patients were males and 32 (23.18%) were women. The average age was 45. Compared with moderate patients, median age 55 years vs. 40 years was older in patients with severe conditions. They had more fundamental comorbidities such as cardiovascular disease (8[5.7%] vs. 0), malignancy (5[3.6%] vs. 2[1.4%]), diabetes (13[9.4%] vs. 4[2.8%]), and high blood pressure; (6[4.3 percent] vs 12[8.6 percent]).

Most of the patients had an epidemic background.

Table 1: Demographic Characteristics of COVID-19 Patients. (Significant p-value < 0.05)

Characteristics	All patients (n=138)	Severe cases (n=51)	Mild Cases (n=87)	p-value
Living or traveling from epidemic area	82 (59.4%)	29 (56.8%)	53 (60.9%)	0.0203
Contact with positive patients	34 (24.6%)	13 (25.4%)	21 (24.13%)	0.409
No contact history	18 (13.04%)	8 (15.6%)	10 (11.4%)	0.125
Comorbidities	54 (39.13%)	21 (41.7%)	33 (37.9%)	0.003
Hypertension	18 (13.04%)	6 (11.7%)	12 (13.7%)	...
Malignancy	6 (4.34%)	2 (3.9%)	3 (3.44%)	...
Smoking history	14 (10.1%)	5 (9.8%)	9 (10.3%)	...
Cardiovascular disease	8 (5.79%)	8 (15.6%)	0	...

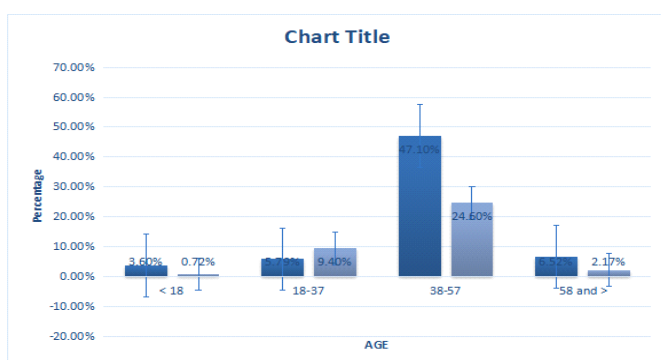


Figure 1: Percentages of COVID-19 patients with in different age groups

Chest CT observations: Lung parenchyma abnormalities were detected in 49 (35.5%) individuals whereas normal chest RT outcomes were seen in 89 (64.4%). 35 (71.4%) of 49 patients with abnormal CT results had bilateral pulmonary

implication. Twenty-eight (57.1 per cent) patients exhibited 5 lobe involvement, whereas 9 (18.3 per cent) showed single lobe involvement and two lobe involvement. In 49 (100 percent) patients, 24 (48.9 percent) were posteriorly distributed, whereas 26 (53.06 percent) were post- and pre-distributed. But none of the patients exhibited anterior distribution on their own.

There was no purely central distribution in any of the cases. In 47 (95%) patients peripheral distribution was detected, 14 (8.16%) of which had peripheral and central distributions, while 33 (67.3%) had peripheral distribution. In 48 (97.9 percent) individuals, the main anomaly, Ground Glass Opacity (GGO) was found. GGO mixed consolidation has been found in 17 (35.41%), 19 (39.5%) individuals with intralobular and interlobular septal thickening, and 13 (27.08%) patients with pure GGO.

Table 2: Chest CT findings

CT findings of Lung abnormalities	No. of patients	%
Absent	89	64.4%
Present	49	35.5%
Lung Involvement		
Right lung	5	10.2%
Left lung	7	14.2%
Bilateral	35	71.4%
Lobular involvement		
Left upper lobe	39	79.5%
Left middle lobe	41	83.6%
Left lower lobe	28	57.14%
Right lower lobe	43	87.7%
Right middle lobe	36	73.46%
Right upper lobe	46	93.87%
1 lobe	5	10.2%
2 lobes	4	8.16%
3 lobes	1	1.6%
4 lobes	11	22.4%
5 lobes	28	57.1%
Opacity location		
Central	0	0
Peripheral	33	67.3%
Central and peripheral	14	8.16%

Significant difference was witnessed while comparing clinical findings and CT score (< 0.002). In critical category the CT mark was higher significantly while making multiple comparisons (mean value \pm SD: 23.6 \pm 3, 15-24) as compared

tomild category (7.6 ± 5 ; range 1-18) ($p < 0.002$). In severe category CT score was significantly higher (20.4 ± 2.9 ; range 15-30) than in mild cases (9.3 ± 4 ; range 0-15) ($p < 0.002$). Between critical and severe categories no significant value have been observed ($p = 0.7921$).

IV. DISCUSSION

The existence of bilateral GGOs is termed COVID-19 whether or not the regions of consolidation are present as shown by this study⁷. It was found that the presence of GGOs reflected the link between the imagery and interstitial thickening of the acute phase diffuse alveolar injury in the early stages⁸. In the late development of illness, activation of T and B virus mediated cells causes autoimmune responses, generating strong inflammatory cytokines⁹. Due to the variety of conditions, including subclinical forms and asymptomatic diseases coupled with clinical course of ARDS, it is unexpected.

Ferritin is a crucial modulator of immunological disorder and adds a great deal to cytokine tempests that may cause the severity of the disease. An rise in ferritin levels might induce serious Covid-19 problems. One research revealed a higher proportion of serum ferritin in very severe COVID-19 individuals. Another study showed a strong link between increasing ferritin levels and mortality. They noted that, within 16 days of hospitalisation, the median ferritin level surpassed 9 normal range, increasing the risk of death¹⁰.

No accessible prognostic biomarkers are available to identify individuals who need immediate medical care or to estimate the death rate¹⁰. Correlation of progression of disease CT prediction and clinical results may be useful to clinically assisting patients in early treatment, however COVID-19 therapy is based instead on empirical judgments. The assumption was verified by the use of Pan et al. lobular-centered validated CT score¹¹.

Comparison of CT score with independent risk variables linked to ARDS classified as age, co-orbidity, and dyspnea¹². The mortality statistics have proven the relevance of predictive age, as the mortality rate was greater in patients aged 70 or beyond. In several individuals with positive RT-PCR results, we found negative CT. Although the results were published by Korea, China and Europe, 61%-100% of patients with RT-PCR verified lung-parenchymal abnormalities showed COVID-19 patients¹³. A research showed 71.8% CT positive outcomes in confirmed patients

with clinical symptoms in COVID-19. The percentage of critical cases reported in the research was 10.2%, 59% common and 30.5% mild¹⁴. Caruso D et al. noted that in symptomatic individuals 96.6% of pulmonary results were found on CT. The main symptoms were fever (61%), while 56% were coughed and 33% had dyspnea¹⁵. A research found a 100% CT positive rate in which 2/3 of dyspnea 10 percent and fever 86 percent showed moderate symptoms¹⁶. The symptomatic COVID-19 individuals in the community were verified by the CT findings compared with data from other nations. CT scans are only conducted in positive patients of RT-PCR, but not in all symptomatic patients, and this is why our nation has a low incidence of CT. Comorbid diseases have been related with an increased severity rate¹⁷. Patients who had lung parenchymal abnormalities on chest CT also had multilobar and bilateral pulmonary opacification distribution. Our results are consistent with the location and kind of pulmonary opacity seen in COVID-19 patients. The predominant abnormality was pure GGO (13) and GGO (17) with mixed consolidation. The results are consistent with several research reported in Review 18 by Salehi et al.

V. CONCLUSION

CT results can help anticipate the transitory result of positive COVID-19 patients. In minimally symptomatic RT-PCR patients, a substantial proportion (64.4%) of normal chest CTs were seen as positive COVID-19. The same CT characteristics have been found in CT positive patients, as numerous investigations in bilateral and multilobar dispersion with peripheral and post-predilection have documented with most of GGOs. This study highly suggests chest CT for COVID-19 positive individuals who are shown to be beneficial in avoiding people with low illness probability.

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